recording instruments were introduced, the extremes were determined from midnight to midnight, local standard time. As both the maximum and minimum temperatures for the day usually occurred before the last observation, it is thought no important differences exist in the resulting means obtained from these readings over the different parts of the country.

With nearly 50 years of record now available for many stations it is possible to compute averages with considerable accuracy and the mean daily values submitted herewith are based upon averages uniformly determined from the daily extremes, and covering the period July 3, 1875, to July 2, 1921, 46 years of record. This series of means, unlike any previously used, as stated above, is practically homogeneous throughout the period of years considered, and the data from all parts of the country are placed upon a strictly comparable basis. The differences between the means obtained from the daily extremes and the true means, determined from hourly observations throughout the entire 24-hour period, are materially affected by local topography, distance from large bodies of water, etc. These differences were carefully analyzed by Professor Bigelow, appropriate corrections to the 24-hour means determined by him, and set forth by charts in Bulletin S of the Weather Bureau. The charts [not reproduced here.—*A. J. H.*] show how small the corrections generally are for the continental United States; on account of this smallness they have not been incorporated in the present tables.

Terminal adjustment.—Every complete cycle like the annual march of temperature must, of course, close upon itself, that is, the normal value for a given day at the beginning of the cycle must be identical with the value for the same day one year later. Average values for corresponding days even when derived from a long series of observations rarely or never satisfy this requirement. Quite a common practice among students in such cases consists in adjusting the two terminal values of the cycle to identity by distributing the discrepancy proportionately to all intermediate values of the whole series. This practice really has no physical basis of justification whatever in the case of many years of observations, because the discrepancy in question is characteristic of only a few values of the data immediately contiguous to the terminal values. Therefore, it is best in such cases to make no correction at all for terminal inequality, but to begin and end the cycle at a time when conditions fluctuate the least, that is, the summer season in the present case. Any outstanding discrepancy in the data itself will then be best disposed of by the subsequent mathematical analysis or by the drawing of smooth curves if that method is employed.

Choice of phase interval.—The superior advantages of the week as a sub-unit for the detailed analysis of the annual march of temperature are largely self-evident and were convincingly presented by one of the writers in the MONTHLY WEATHER REVIEW, August, 1919, 47: 544–555. Accordingly, this unit was adopted and daily averages of the maximum and minimum temperatures were prepared separately at all stations having 20 years of record or more. From these, weekly averages were computed. Although the schedule of weeks begins with January 1 to 7, so as to fit the calendar year, the tabulation of the data was made to begin with the week comprising the days July 3 to 9, so as to avoid the large terminal discrepancies which arise from a tabulation by calendar years. In leap years, the temperature for the 29th day of February was merged at ¼ weight with the week naturally comprising that date. Furthermore, the extra day over 52 weeks in all years was merged as an 8th day in the week beginning April 16. This date was chosen because the mean temperature for the year occurs about at this time and the inclusion of the extra day then would make the mean of the 52 weekly values of the data most nearly identical with the mean of the 365 individual days.

On account of the varying dates attending the beginning of observations at the respective stations it was considered that all stations having from 40 to 45 years of record were of sufficient length to give normals that would not be appreciably changed by the addition of the few years necessary to complete the full 46-year period. Of the stations appearing in the following tables, 93 had lengths of record varying from 40 to 46 years; the remainder, or 71, had lengths of record ranging from 20 to 39 years, and in these cases the records were corrected to the full 46-year period by the usual methods employed in such cases, that is, by comparing the shorter series with similar periods for near-by points and determining and applying the corrections necessary to reduce the weekly values to the full period of 46 years.

In accordance with the plan described in the foregoing, there were derived 52 weekly values of maximum and minimum temperatures for a total of 164 stations, well distributed over the continental United States and including the stations at Honolulu and San Juan, all (except the two last mentioned) adjusted to a period of 46 years. These constitute extremely valuable basic meteorological data and it is contemplated to publish them separately in full, together with a discussion of the residuals from the harmonic analysis and smooth curves.

METHODS OF ANALYSIS

Two methods were employed to derive daily normals from the weekly averages.

First method.—For the 93 stations having 40 or more years of records, the weekly means were subjected to a four-term Fourier analysis and 52 values of normal temperatures were computed therefrom. These, of course, were separated from each other by an exact interval of $7\frac{1}{52}$ days. By an appropriate and progressive adjustment these computed values were transformed to 52 values at intervals of exactly 7 days, except that the 52d week, beginning June 26, was made to contain 8 days.

It is considered unnecessary to outline the arithmetical processes followed in computing these weekly values, but they are recognized as superior to the methods usually followed in drawing free-hand curves through the observed data. From these weekly normals intermediate daily values were easily interpolated for both the maximum and minimum separately. The mean of the two normal extremes is considered to give a normal daily mean temperature of great significance, and these are the values given in the accompanying tables.

Second method.—For stations with a length of record from 20 to 39 years the final daily values of the normal maximum and the normal minimum temperatures were obtained by drawing smooth curves through the 52 weekly averages and scaling the daily values therefrom, similar to the manner of obtaining the data given in Bulletin R previously explained, save that the number of points available for plotting was increased from the 12 mean monthly values to 52 means for the respective weeks, the increase in the number of points affording opportunity to produce a curve upon which could be located with considerable accuracy the extreme points, and the proper rate of change in the varying portions of the month.

This supplement is not for general free distribution. It will be sent free to cooperating meteorological services and institutions, and to individuals and organizations that have cooperated with the Bureau in this research. Copies of the Supplement may be had from the Superintendent of Documents, Washington, D. C., at the price of 20 cents. Remittances should be made to that official and not to the Weather Bureau.

COTTON GROWING IN RELATION TO CLIMATE IN EGYPT AND THE SUDAN

[Abstracted by J. B. Kincer from Technical and Scientific Service Bull. No. 47, of the Ministry of Agriculture, Egypt]

In 1923, the Ministry of Agriculture of Egypt published a report by Mr. C. B. Williams on the cotton plant in relation to temperature and rainfall, (Technical Bulletin No. 32, Cairo), which was abstracted for the June, 1924, number of this Review, pages 306 and 307. In a more recent bulletin (No. 47, 1924), the same author treats of climatic conditions and their relation to the growth of cotton in Egypt and the Sudan. The climatic factors considered are temperature, moisture, wind, and light.

This study is of unusual interest because of the fact that cotton in Egypt, grown principally in the extreme lower Nile Valley, is a summer crop, while in the Sudan, extending from the central and southern districts of the Red Sea westward to the upper Nile Valley, it is grown as a winter crop. In Egypt the seeds are planted on a rising temperature, usually when the mean daily values rise to about 60°, while in the Sudan they are planted on a falling temperature, ranging from 90° to 80°. The lowest temperature of record at any of the Egyptian stations in the cotton area is 25°, while in the Sudan the lowest of record is 37°, and by reason of the difference in the time of the cotton season, the growing plants escape the extreme cold in Egypt and the extreme heat of the Sudan.

In both sections cotton is mainly, but not entirely, dependent upon irrigation. There are a few places in the southern Sudan where it is grown under natural rainfall, and in a few other low-lying parts irrigation is not practiced, but in these cases percolation takes place from the surrounding country. In some cases the crop is dependent on the flood waters of the rivers, and in others on the artificial application of moisture. Because of the fact that evaporation is high in regions where irrigation must be practiced, this factor is given considerable attention; in Egypt, cotton is produced at the time of greatest evaporation, and in the Sudan at the time of the least.

Mr. Williams makes the following comments on the number of hours of daylight under which cotton is grown in the two sections:

Recent investigations have shown that the number of hours of daylight to which a plant is exposed may have great influence on its periods of grówth and maturity. Without wishing to make any statement as to whether or not cotton is so influenced, it may be of interest to put on record on the same form of diagram the actual number of hours of daylight in the different localities in the different stages of the crop.

The figure for any month is of course directly dependent on the latitude of the locality. And in view of the more or less proportional changes, the value for only two localities in Egypt and two in the Sudan have been shown.

They show that while the Sudan has the most hours of daylight in the close season, during the growing period the cotton here has two to three hours a day less than in Egypt. As the Sudan is probably the furthest locality from the Equator at which cotton is grown as a "winter" crop, it is probable that these figures represent the shortest hours of daylight under which cotton is cultivated.

The longest hours will probably be found in the few small localities in Bulgaria where cotton is grown as a summer crop in a atitude of 40° north.

The greatest similarity of conditions between Egypt and the Sudan is found at the time of planting and again at about the middle of picking.

USE OF THE BEAUFORT SCALE OF WIND BY THE UNITED STATES WEATHER BUREAU

The Beaufort Scale, with certain changes which have varied from time to time, has been in use by the Bureau since 1905 except for the years 1909–1914, during which a 7-point scale was used. Though this scale was based on the Beaufort Scale, its use nevertheless constituted a virtual abandonment of the Beaufort notation. When the fourth edition of the Smithsonian Meteorological Tables, published in 1918, was in preparation, under the supervision of the Weather Bureau, the table of the Beaufort Scale containing equivalents according to Scott, which appeared in the third edition, was replaced by a a table taken from the Observers' Handbook of the British Meteorological Office, containing the equivalents as determined by Simpson. This was done because the Simpson values appeared to rest upon a more satisfactory experimental basis than any others available.

Use of the Beaufort Scale had been resumed by this Bureau in 1914, but experience has since demonstrated that for purposes of forecast terminology in this country the Beaufort Scale numbers are too numerous and too restrictive in velocity ranges to be practicable. Therefore, to meet the needs of the forecaster and at the same time to retain for other purposes the advantages of the full Beaufort notation, the scale as given herewith was put into effect on January 1, 1925. This brings the scale as now used into harmony with that in the revised Smithsonian Meteorological Tables. As stated in the report of the committee of this Bureau on revision of the scale:

It appears that while the version of the Beaufort Scale now used by the British Meteorological Office, with anemometric equivalents determined by Simpson, has not been formally adopted by other countries, it has a certain degree of international authority on account of its incorporation in the English edition of the International Meteorological Codex, and, on account of the preponderance of British shipping, it is probably more widely used by mariners than any other. The increasing cooperation between the United States and England in the exchanging of vessel reports; the fact that England was the originator of the scale and has done more than any other nation in scientific correlation of the scale values to anemometry records were also considered as justifying the U. S. Weather Bureau in adopting the Beaufort Scale (Simpson) as used by England.

Beaufort scale of wind, with velocities and descriptive terms

Beaufort No. (a)	Explanatory titles (b)	Mode of estimating aboard sailing vessels (c)	Specifications for use on land (d)	Miles per hour (statute) (c)	Terms used in U. S. Weather Bureau forecasts (f)
0	Calm	----------	Calm; smoke rises vertically.	Less than 1	Light.
1	Light air	Sufficient wind for working ship.	Direction of wind shown by smoke drift, but not by wind vanes.	1–3	
2	Slight breeze		Wind felt on face; leaves rustle; ordinary vane moved by wind.	4–7	
3	Gentle breeze		Leaves and small twigs in constant motion; wind extends light flag.	8–12	Gentle.
4	Moderate breeze	Forces most advantageous for sailing with leading wind and all sail drawing.	Raises dust and loose paper; small branches are moved.	13–18	Moderate.
5	Fresh breeze		Small trees in leaf begin to sway; crested wavelets form on inland waters	19–24	Fresh.
6	Strong breeze	Reduction of sail necessary with leading wind.	Large branches in motion; whistling heard in telegraph wires; umbrellas used with difficulty.	25–31	Strong.
7	High wind		Whole trees in motion; inconvenience felt in walking against wind.	32–38	
8	Gale	Considerable reduction of sail necessary even with wind quartering.	Breaks twigs off trees; generally impedes progress.	39–46	Gale.
9	Strong gale		Slight structural damage occurs (chimney pots and slate removed).	47–54	
10	Whole gale	Close reefed sail running, or hove to under storm sail.	Seldom experienced inland; trees uprooted; considerable structural damage occurs.	55–63	Whole gale.
11	Storm		Very rarely experienced; accompanied by widespread damage.	64–75	
12	Hurricane	No sail can stand even when running.	----------	Above 75	Hurricane.

December, 1924.

The following historical note by Prof. C. F. Talman on the origin and evolution of the Beaufort Scale, and on the extent to which progress has been made toward giving it international official sanction, is here reprinted from the report of the same committee:

The Beaufort Scale of wind force was introduced by Sir F. Beaufort in 1805 for use on shipboard, and has been more extensively employed than any of the several other scales devised for the noninstrumental observation of wind force. In 1874, it was adopted for international use in weather telegraphy by the Permanent Committee of the First International Meteorological Congress (the predecessor of the present International Meteorological Committee).

The first actual comparisons between anemometer readings and estimates made according to the Beaufort Scale appear to have been those carried out by R. H. Scott on the English coast, beginning in 1869, though several lists of equivalents of the Beaufort numbers in miles per hour or meters per second had been published previously to that time; viz, by Sir Snow Harris, Sir H. James, FitzRoy, Schott, Symons, Jelinek, Neumeyer, and Laughton. The values obtained by Scott were published in the Quarterly Journal of the Royal Meteorological Society, vol. 2, 1874, pp. 109–123. They were adopted by the British Meteorological Office, which used them until 1909, and were also incorporated in many reference books, including the Smithsonian Meteorological Tables. Scott's values are now known to have been seriously in error, on account of his use of the reduction factor 3 in connection with the anemometer reading, as well as for other reasons.

Several later series of comparisons have been made, viz, by Mohn, Chatterton, Curtis, Sprung, and Köppen, and finally by Doctor Simpson, the present director of the British Meteorological Office, whose results were published by that office in 1906 and are now used officially in England.

At the London, 1912, meeting of the International Committee for Weather Telegraphy, Professor Palazzo raised the question of